The pollinia are quite small and occupy only the upper portion of the anther. They are almost cylindrical and are attached to the anther by placentæ which break away with the pollinia forming a hyaline line along their outer sides as arranged in pairs.

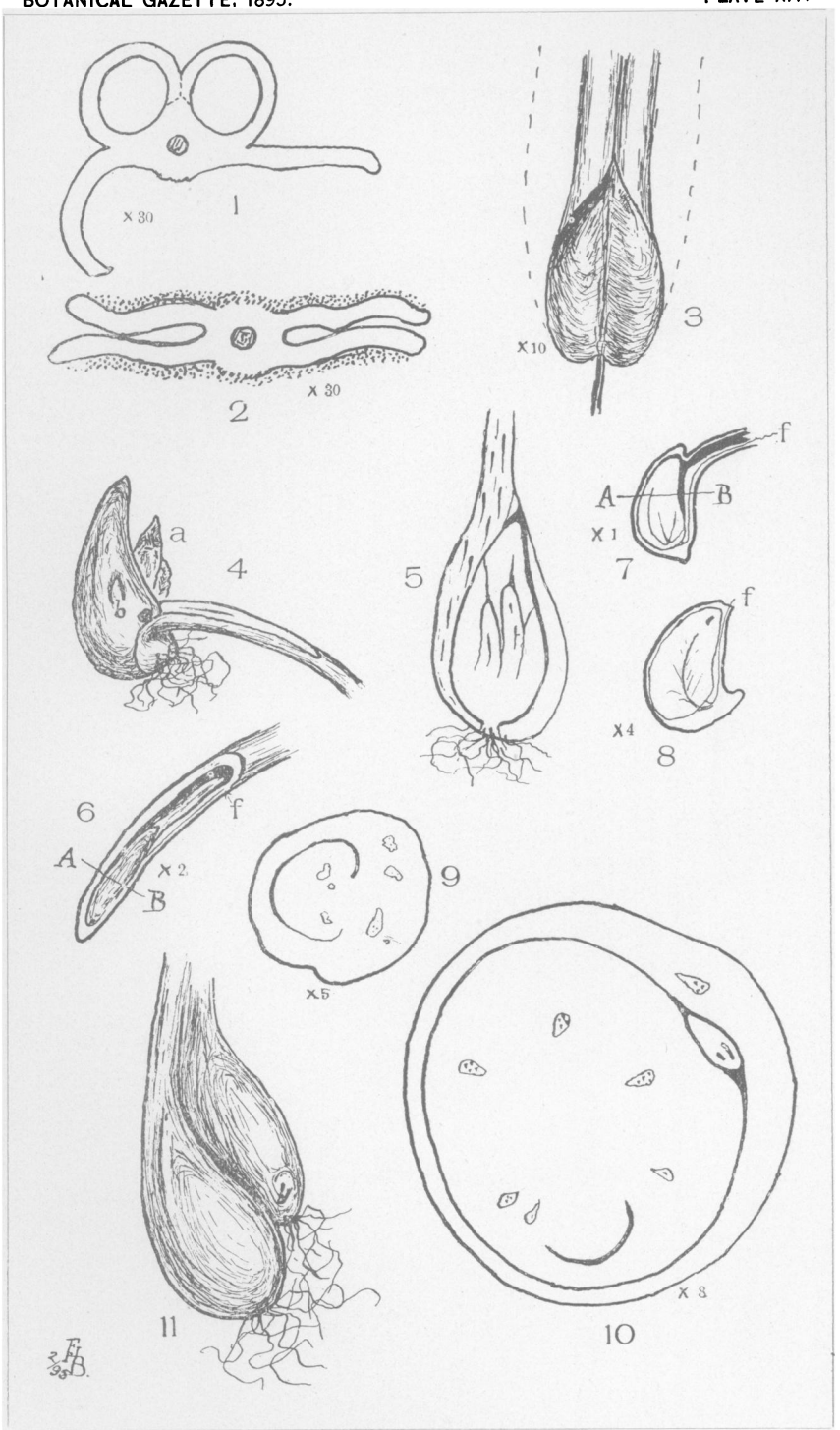
The pollinia of Asclepias with which they are usually compared are larger, occupying the anther from base to apex. They are quite flat and do not exhibit the hyaline line seen in Enslenia.—GEO. H. SHULL, *Sulphur Grove, Ohio.*

EXPLANATION OF PLATE XIII.—Fig. 1. *Enslenia albida* Nutt., a node and cluster of flowers. × 1.—Fig. 2. Diagrammatic view of the inflorescence reduced to a single plane.—Fig. 3. Anther with its appendage. × 10.—Fig. 4. Section near the summit of the central column showing the arrangement and attachment of the pollinia. × 27.—Fig. 5. Section near the base of the central column showing anthers quite empty. × 27.—Fig. 6. Pollinia. × 32.—Fig. 7. Pollinia of *Asclepias incarnata* L. × 32.

On the development of the bulb of the adder's-tongue.—WITH PLATE XIV.—In the BOTANICAL GAZETTE for February, 1894, I presented results of observations made in 1893, upon the adder's-tongue, or spring Lily (*Erythronium Americanum* Ker.), and will here add, results of observations made in 1894 in hopes that as soon as the weather admits others will begin to make observations that may aid in determining questions of growth.

Here at New Brunswick, N. J., the flowers are about a week later than in the vicinity of Washington, D. C., and nearly a week earlier than in the vicinity of Springfield, Mass., the blossoms of the Erythronium being about their prime here on April 27th last year; the runners being at their best about May 5th, and the seeds ripe June 13th. The seeds are not easily found except when the exact spot where the plants grow has been previously noted carefully, for very soon after blooming the plants begin to decay and often the seeds ripen with the ovary on the ground, the remnants of the plant being prostrate and partly hidden by later growths of vegetation. By the first of May the profusion of bloom had passed and buds were found only in sheltered spots.

In the vicinity of Washington the anthers of *E. Americanum* Ker. observed were almost invariably dark brown; here the anthers observed were most frequently yellow, although the brown anthers were not rare. No direct relation was observed between the color of the anthers and the blotching on the leaves, as dark anthers were found on some plants whose leaves were free from brown, but freely blotched with white. The yellow anthers are often found associated with leaves thickly sprinkled with brown spots. All stages between these two extremes were found. As regards fertility, no comparative


x 30
1
x 30
2
x10
3
a
4
5
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A
B
x 1
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A
x 2
B
9
x 5
11
x 3
10

laboratory experiments have been made here as yet, but the plants in the fields have about the same size of ovary in the case of the yellow as in the case of the brown anthers; but the best development reached by any of the plants seen was in those having yellow anthers. These grew in a cool, shady ravine, and within a few feet were other plants having brown anthers, which were but slightly inferior in development.

Nearly seventy-five plants were examined in the field on May 3d, all of which had yellow anthers. These were in various stages, from the recently opened flower to the blossom that had fallen to the ground, but age did not seem to have any effect on the color of the stamens.

The anther opens not by the throwing of the adjacent lateral pollen chambers together, but by the dividing of the dorsal and ventral partitions inward until the elasticity of the walls ruptures the thin remaining portion.[1] The upper half of fig. 1 illustrates by dotted lines the approximate path of such a rupture. This process begins at the base of the dorsal suture and extends upward, as shown in fig. 3, the dotted line indicating the probable position of the walls when fully opened. A transection of a fully opened anther is shown in fig *2*. The pollen covered surface is thus exposed to the wind and insects.

The active mature bulb of one year seems in some cases to be developed from a bud of the previous year, the parent bulb being absorbed in the growth of the bud. Remains of this parent bulb are sometimes adherent to the new bulb, and such a case is shown at *a*, fig. 4. Here the husk has been carefully removed, and the sheathing stalk bent back to show more plainly some details. At *b* is a bud already started although the bulb on which it occurs has not fairly begun its independent life. Figure 5 gives a longisection of a similar bulb showing the young bulb found within the active portion, which is marked with the vascular bundles.

If two buds should develop from the same parent at the same time, there might be produced a growth similar to that in fig. 11, but such contact developments are more likely to occur by the growth of two runner-bulbs in contact.

On account of botanical work at Cottage City, Mass., I could not continue my collecting during the summer, but my father, Mr. James H. Blodgett, kindly collected, at various dates ending with November 28th, over six hundred bulbs of all sizes, from marked spots near Washington, D. C. This collection contains two cases of the "contact developments." One of these is represented at fig. 11, and under careful examination they show no break in the husk; a small bud is

[1] This process is described by Van Tieghem, Traité de Botanique, 882.

developing near the base of the upper one and is pointed downward. It is the first case noticed in which this occurred. That the secondary bulbs are really buds from the primary but immature bulbs, is shown by the structure of the runner-tip. This tip forms the terminal bud of the runner and is shown in fig. 6. The runner is hollow for nearly its full length when in its best condition, the tube tapering toward the upper part. Through the runner some vascular-bundles extend. These are more highly developed near the parent bulb than at the tip, and are surrounded by cells which contain a supply of starch. In a section of a runner-tip at a point corresponding to *A B*, fig. 6, a structure like fig. 9 is seen, the irregular patches being the bundles, and the line cutting off a portion being the boundary of the bud within the runner. Some of these runner-buds in shape closely resemble the seeds, (compare fig. 7 a bud and fig. 8, a seed). Figure 7 shows a longisection of a runner-bud, natural size, as it reaches its full development as a bud. It is now ready to absorb the runner and becomes a bulb.

The bundle, *f*, is seen running down to the base of the bud, and is also shown in a similar position in the seed. The soft spongy portion of the seed is directed away from the placenta, as the point of the bud, just above, is away from the runner. In figs. 9 and 10, in a section of a bud similar to the trans-section *A B* of figs. 6 and 7, the structure is seen to be more highly developed, bearing a resemblance to the bulbs themselves. The bundles are more differentiated and more numerous, and the bud has begun to develop its internal sprout.

The growth of fleshy fibers from the upper part of the runner-bud, (See Bot. Gaz. 19: *pl. 7. fig. 11.* 1894.) noted in 1893 has not been seen since, but such fibers were well developed in that specimen.

As the fibrous roots at the base of the mature bulbs are persistent through the year they are ready to start with the warm weather so that the plants have means for very rapid development, when spring opens.

The immature bulbs develop their roots in order of their size, the smallest not producing theirs until the latter part of October, between October 26th and November 15th, in 1894.

Among the plants collected by the students of Rutgers College last spring one Erythronium was brought in having two flowers, on separate pedicels, but springing from the same point of the plant, which was otherwise normal. In the general herbarium of the institution is a plant bearing a third leaf, which springs from the stem just below the separation of the normal leaves. This third leaf is considerably smaller than either of the others. Another plant has a blossom, with

the bulb less than an inch and a half below the surface. It was apparently trying to get deeper, as a strong runner had started from the bottom of the bulb.—FREDERICK H. BLODGETT, *Rutgers College, New Brunswick, N. J.*

John H. Redfield.—The death of Mr. John H. Redfield, conservator of the herbarium of the Academy of Natural Sciences of Philadelphia, which occurred in that city on the twenty-seventh of February, is regarded as a serious loss to the science he loved. He was for many years a member of the car-wheel manufacturing firm of that city, Asa Whitney & Sons, the founder of the firm being his father-in-law. His spare time from his business was devoted to self-culture, especially to learning languages, and studying natural history. He became a thorough Greek and Latin scholar, and continued the acquisition of modern languages through life, having mastered Spanish but a few years before his death. In natural history he was proficient in chemistry, mineralogy, conchology, and botany—the later years of his life being wholly devoted to the latter pursuit. In the knowledge of ferns he had few superiors anywhere, and workers in this group of plants were always happy in examining his rare collection, and profiting by his wide knowledge. The greatest monument to his labors will be the herbarium of the Academy of Natural Sciences of Philadelphia.

He retired from active business in 1885, and from that time devoted his whole time to building up this herbarium. Though with good material collected by many eminent men, it was in a sad state in the early sixties. On the death of Elias Durand, only one worker was left to give a few hours a day to its care. Its condition may be imagined by the reply of Dr. Gray to an application for a share in some specimens, "what is the use of throwing valuable material into a dust bin?" The letter, shown to Mr. Redfield, stirred a strong desire to give encouragement. During his noon recess from business he would call to enquire how the work was coming on. From this beginning he left the herbarium at his death with over 35,000 species of flowering plants and ferns, accurately determined, with many suites of specimens to show geographical range and variations, with a very large number undescribed. He had undertaken the immense labor of verifying and fastening to sheets the huge collection, and had more than half completed the task, leaving an unfinished genus on the table to take to his death bed. By his will he leaves all his books and collections of natural history to be sold, the proceeds to be devoted to continuing the work on the herbarium. This will start a "Redfield Memorial Hebarium Fund," by which the memory of his unselfish labors will be perpetuated.